THAT WHICH IS CLAIMED:

1. A system for reducing the infrared signature of an engine, the system comprising:

an engine passage extending between an inlet end and an exhaust end and structured to receive at least one gas therethrough;

a fuel source configured to supply a fuel for combustion in the engine passage;

at least one combustion device in the engine passage configured to combust the fuel in the engine passage;

a nozzle at the exhaust end of the engine passage structured to receive the gas from the engine passage and discharge the gas; and

a heat exchanger configured to receive a flow of a fluid and a flow of the fuel before the fuel is combusted, transfer thermal energy from the fluid to the fuel to cool the fluid, and deliver the cooled fluid to the nozzle, thereby cooling the nozzle and reducing the infrared signature of the engine.

2. A system according to Claim 1 wherein the engine passage defines a central passage and a fan duct extending in a longitudinal direction of the engine passage, the fan duct being configured to receive air therethrough, the heat exchanger being disposed in the fan duct and configured to receive air passing therethrough and transfer thermal energy from the air to the fuel to cool the air in the fan duct.

3. A system according to Claim 2, further comprising an augmentor configured to receive the fuel and discharge the fuel into the central passage for combustion at a longitudinal location between the turbine and the nozzle, the heat exchanger being disposed in the fan duct at a position that is longitudinally proximate to the augmentor.

4. A system according to Claim 1 wherein the heat exchanger is an augmentor configured to receive the fuel and operate selectively in first and second modes, the augmentor in the first mode being configured to circulate the fuel therethrough and transfer thermal energy to the fuel, and the augmentor in the second mode being configured to receive the fuel and discharge the fuel into the engine passage for combustion therein.

5. A system according to Claim 1 wherein the heat exchanger is positioned outside the engine passage and configured to receive a flow of air, transfer thermal energy from the air to the fuel, and deliver the cooled air to the engine passage.

6. A system according to Claim 5, further comprising a turbocooler, the turbocooler having a compressor and a turbine, the compressor of the turbocooler being configured to compress the air and provide the air to the heat exchanger, and the turbine configured to receive the air from the heat exchanger, expand and cool the air, and deliver the air to the engine passage.

7. A system according to Claim 5 wherein the heat exchanger is configured to receive the air from a compressor in the engine passage, the air being compressed by the compressor in the engine passage during operation of the engine.

8. A system according to Claim 1 wherein the heat exchanger is configured to heat the fuel to a temperature of at least 300 °F.

9. A system according to Claim 1 wherein the fuel source is configured to supply a high heat sink fuel that is stable at a temperature greater than 300 °F.

10. A system according to Claim 1, further comprising a precooler heat exchanger configured to receive a flow of compressed air from a compressor in the engine passage and a flow of the fuel, the air being compressed by the compressor in the engine passage during operation of the engine, and the precooler heat exchanger transferring thermal energy from the air to the fuel.

11. A system according to Claim 1, further comprising a transducer disposed in the heat exchanger between the flow of the fluid and the flow of the fuel, the transducer configured to convert thermal energy from the fluid to electricity.

12. A system for reducing the infrared signature of an engine, the system comprising:

an engine passage defining a central passage and a fan duct extending in a longitudinal direction between an inlet end and an exhaust end;

a fuel source configured to supply a fuel for combustion in the central passage;

at least one combustion device in the central passage configured to combust the fuel to form an exhaust gas;

a nozzle at the exhaust end of the engine passage structured to receive the exhaust gas from the central passage and discharge the exhaust gas; and

a heat exchanger disposed in the engine passage and configured to receive a flow of the fuel from the fuel source and circulate the fuel to the combustion device, the heat exchanger being configured to transfer thermal energy from the engine to the fuel, to thereby cool at least a portion of the engine and reduce the infrared signature of the engine.

13. A system according to Claim 12 wherein the heat exchanger is disposed in the fan duct and configured to receive air passing therethrough such that the air thermally communicates with the fuel in the heat exchanger, thereby cooling the air in the fan duct.

14. A system according to Claim 12 wherein the heat exchanger is an augmentor configured to receive the fuel and operate selectively in first and second modes, the augmentor in the first mode being configured to circulate the fuel therethrough and transfer thermal energy to the fuel, and the augmentor in the second mode being configured to receive the fuel and discharge the fuel into the central passage.

15. A system according to Claim 12 wherein the heat exchanger is configured to heat the fuel to a temperature of at least 300 °F.

16. A system according to Claim 12, further comprising a precooler heat exchanger configured to receive a flow of the fuel and a flow of compressed air from a compressor in the engine passage, the air being compressed by the compressor in the engine passage during operation of the engine, the precooler heat exchanger transferring thermal energy from the air to the fuel.

17. A system according to Claim 12, further comprising a transducer disposed in the heat exchanger and configured to be heated by the nozzle and convert thermal energy from the nozzle to electricity.

18. A system according to Claim 12 wherein the fuel source is configured to supply a high heat sink fuel that is stable at a temperature greater than 300 °F.

19. A system for reducing the infrared signature of an engine, the system comprising:

an engine passage defining a central passage and a fan duct extending in a longitudinal direction of the engine passage between an inlet end and an exhaust end;

a fuel source configured to supply a fuel for combustion in the central passage;

a first compressor in the central passage configured to provide a flow of compressed air for combustion with the fuel in the central passage;

at least one combustion device in the central passage configured to combust the fuel with the compressed air to form an exhaust gas;

a nozzle at the exhaust end of the engine passage structured to receive the exhaust gas from the central passage and discharge the exhaust gas; and

a heat exchanger disposed outside the engine passage and configured to receive a flow of the fuel from the fuel source and circulate the fuel to the combustion device, the heat exchanger also being configured to receive a flow of air, transfer thermal energy from the air to the fuel to cool the air, and deliver the cooled air to the engine passage to thereby cool the nozzle and reduce the infrared signature of the engine.

20. A system according to Claim 19, further comprising a turbocooler, the turbocooler having a second compressor and a turbine, the second compressor being configured to receive air from the first compressor, compress the air, and provide the

air to the heat exchanger, the turbine being configured to receive the air from the heat exchanger, expand and cool the air, and deliver the air to the engine passage to thereby cool the nozzle.

21. A system according to Claim 20, further comprising a precooler heat exchanger configured to receive a flow of compressed air from the first compressor in the engine passage and a flow of the fuel, the precooler heat exchanger transferring thermal energy from the air to the fuel, and the second compressor of the turbocooler being configured to receive the air from the first compressor via the precooler.

22. A system according to Claim 19 wherein the heat exchanger is configured to heat the fuel to a temperature of at least 300 °F.

23. A system according to Claim 19, further comprising a transducer disposed in the heat exchanger and configured to be heated by the air therein and convert thermal energy from the air to electricity.

24. A system according to Claim 19 wherein the fuel source is configured to supply a high heat sink fuel that is stable at a temperature greater than 300 °F.

25. A method for reducing the infrared signature of an engine, the method comprising:

combusting fuel and air in an engine passage to form an exhaust gas that is discharged from the engine passage through a nozzle;

circulating a flow of the fuel through a heat exchanger disposed in the engine passage; and

delivering the fuel from the heat exchanger to the combustion device for combustion,

wherein the heat exchanger thermally communicates with at least one of the air and the nozzle and transfers thermal energy therefrom to the fuel to thereby cool the nozzle and reduce the infrared signature of the engine.

26. A method according to Claim 25 wherein said circulating step comprises circulating the fuel through the heat exchanger in a fan duct of the engine passage to cool a flow of the air through the fan duct.

27. A method according to Claim 25 wherein said circulating step comprises circulating the fuel through an augmentor in a central passage of the engine passage, and further comprising selectively operating the augmentor in first and second modes, the augmentor in the first mode circulating the fuel therethrough and transferring thermal energy to the fuel, and the augmentor in the second mode discharging at least a portion of the fuel into the central passage for combustion therein.

28. A method according to Claim 25 wherein said circulating step comprises heating the fuel to a temperature of at least 300 °F.

29. A method according to Claim 25, further comprising circulating the fuel through a precooler heat exchanger and delivering a flow of compressed air from a compressor in the engine passage to the precooler heat exchanger, the precooler heat exchanger transferring thermal energy from the air to the fuel.

30. A method according to Claim 25, further comprising heating a transducer with at least one of the air and the nozzle and converting thermal energy therein to electricity.

31. A method according to Claim 25, further comprising providing the fuel as a high heat sink fuel that that is stable at a temperature greater than 300 °F.

32. A method for reducing the infrared signature of an engine, the method comprising:

combusting fuel and air in an engine passage to form an exhaust gas that is discharged from the engine through the nozzle;

circulating a flow of the fuel through a heat exchanger disposed outside the engine passage;

delivering a flow of air through the heat exchanger and thereby transferring thermal energy in the heat exchanger from the air to the fuel to cool the air;

delivering the fuel from the heat exchanger to the combustion device for combustion; and

delivering the cooled air to the engine passage to thereby cool the nozzle and reduce the infrared signature of the engine.

33. A method according to Claim 32, further comprising compressing the flow of air passing through the heat exchanger in a compressor of a turbocooler before the air is cooled in the heat exchanger, and expanding the air from the heat exchanger in a turbine of the turbocooler to thereby cool the air before the air is delivered to the engine passage to cool the exhaust nozzle therein.

34. A method according to Claim 33 further comprising circulating the air through a precooler heat exchanger before the air is compressed in the compressor of the turbocooler, the precooler receiving a flow of fuel and transferring thermal energy from the air to the fuel.

35. A method according to Claim 32 wherein said circulating step comprises heating the fuel to a temperature of at least 300 °F.

36. A method according to Claim 32, further comprising heating a transducer with the air in the heat exchanger and converting thermal energy from the air to electricity.

37. A method according to Claim 32, further comprising providing the fuel as a high heat sink fuel that that is stable at a temperature greater than 300 °F.